

Design Guidelines For Customer-Supplied Hubs

TN-1102 | REV 160602

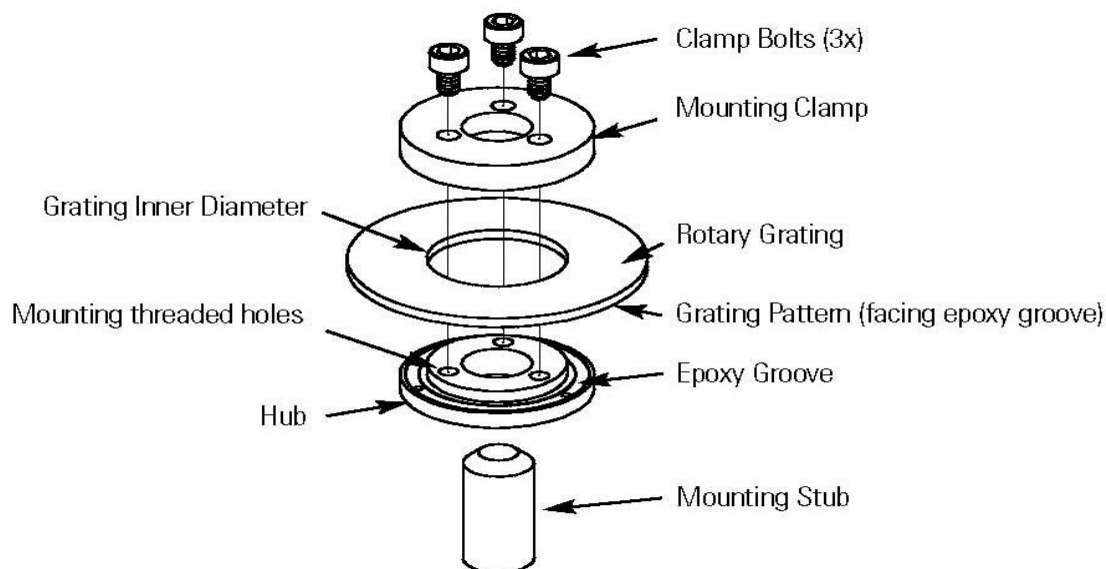
INTRODUCTION

MicroE offers standard hubs for each of our standard gratings. Should a customer want to design a hub themselves, these guidelines describe the key factors to incorporate into the design.

Once the hub design has been completed, we recommend that the hub drawing be sent to the MicroE Applications Engineering group for review.

After the hub has been manufactured, it can be sent to MicroE to have the grating mounted. The customer can also mount the grating to the hub themselves. However, if the grating is not mounted correctly to the hub, the accuracy of the encoder system will be compromised. The "Alignment of Rotary Scales" Tech Note provides for further information on mounting rotary gratings.

Exploded view of hub, grating and mounting clamp



The illustration above shows how the grating is clamped to the hub for the mounting and aligning process.

Figure 1

RECOMMENDED FEATURES

MicroE recommends three basic features of a hub for rotary encoder gratings:

- A reference diameter to which the grating's optical diameter should be centered. This can be either an ID for shaft mounting or an OD.
- A glue groove bounded by very coplanar shoulders. This will provide a flat mounting surface for the grating and ensure a tight seal to the glue groove to prevent squeeze-out.
- Tapped mounting holes to secure the temporary mounting clamp during centering/bonding.

HUB DESIGN

1. We strongly recommend mounting the scale with the grating pattern surface contacting the mounting surface of the hub. Mounting the scale in this manner eliminates all variation in grating thickness that can be as much as ± 0.008 inches (± 0.20 mm) from the Z-axis alignment of the sensor head to the grating pattern.

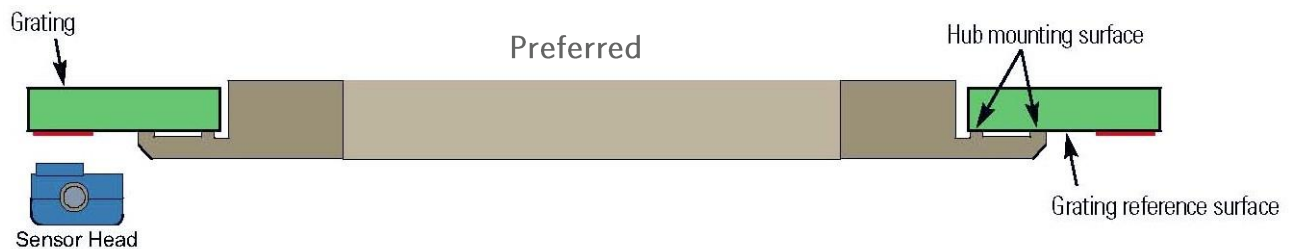


Figure 2

The illustration above shows the recommended orientation of grating and the hub where the grating's pattern surface is contacting the hub's mounting surface.



Figure 3

The illustration above shows the less desirable grating orientation where the back of the grating is contacting the hub's mounting surface. This orientation will include the variations that can occur from one grating to the next into the Z-axis alignment tolerance and may necessitate the addition of either Z-axis sensor adjustment or axial hub adjustment into the encoder mounting design.

2. Verify that there is sufficient clearance between the OD of the hub and the ID of the grating. The radial gap between grating and hub shoulder should be 0.018 -0.00/+ 0.004 inches (0.46 -0.00 /+0.10 mm)

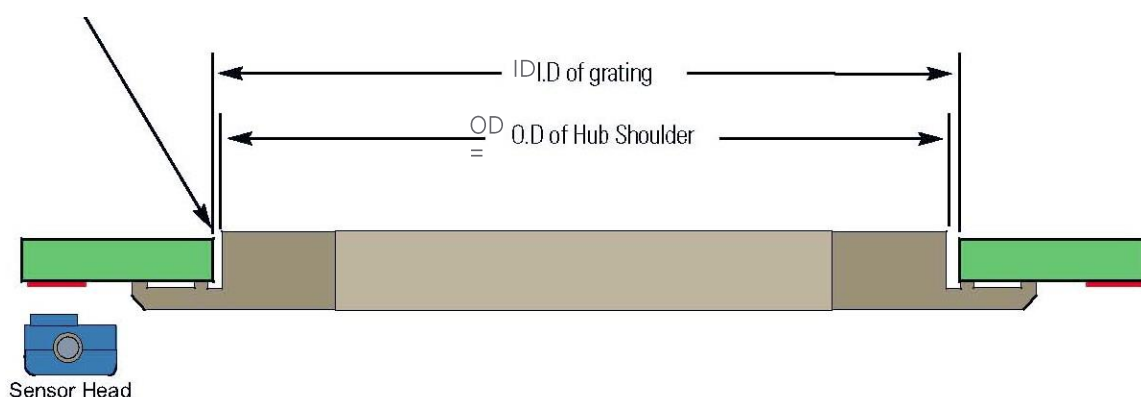


Figure 4

3. If it is not possible to mount the grating pattern surface (pattern side) facing the mounting surface of the hub (see #1 on the previous page), avoid making contact with the grating directly underneath the optical pattern. Laser light reflected off the hub can increase the noise level at the sensor head.

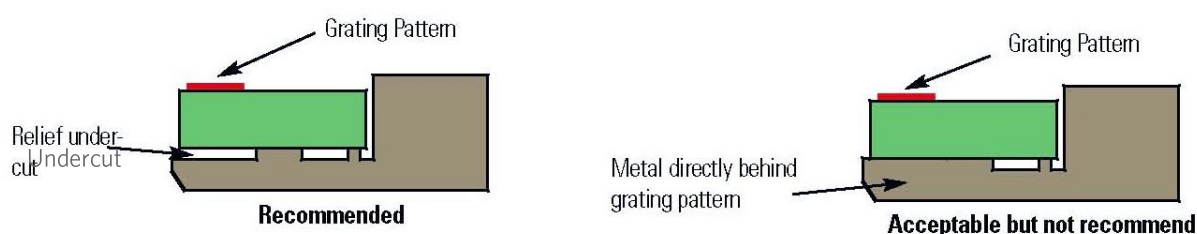


Figure 5

4. If possible, the shoulders on either side of the epoxy groove should have a minimum width of 0.079 inches (2 mm).

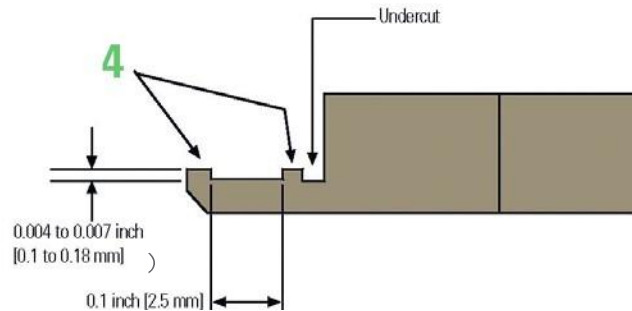


Figure 6

5. Verify depth and width of the epoxy groove.

Note: An undercut at the shoulder is recommended to prevent any radius at the inside corner upon which the grating ID might ride up during centering.

6. The hub's shoulder should be at least 0.12 inches (3.1 mm) wide to allow sufficient clearance for mounting screws.
7. Bottom of epoxy groove should have a rough finish. If the surface is very smooth, the epoxy will not adhere properly and the bond between the grating and the hub may be compromised.
8. Verify that the sizes of the three threaded mounting holes are correct through the table in Figure 7.
9. Verify the number of Epoxy holes is correct in Figure 7.

Epoxy Groove Diameter	Number of Epoxy Holes	Epoxy Hole Size	Number of Tapped Holes	Thread Size
Up to 0.42 (Up to 10.7)	None	.062 (1.55)	None	
0.42 to 0.7 (10.7 to 17.8)	3	.062 (1.55)	3	0-80 UNC (M1.7)
0.7 to 1.2 (17.8 to 30.5)	3	.062 (1.55)	3	2-56 UNC (M2)
1.2 to 2.2 (30.5 to 55.9)	3	.062 (1.55)	3	8-32 UNC (M4.2)
Above 2.2 (55.9)	6	.062 (1.55)	3	8-32 UNC (M4.2)

Note: For very large hubs, epoxy injection holes should be no more than 1 inch apart.

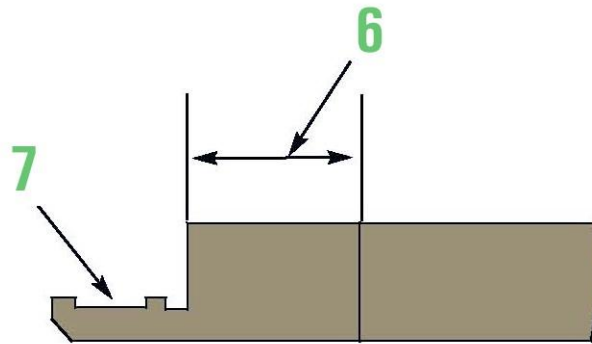


Figure 8

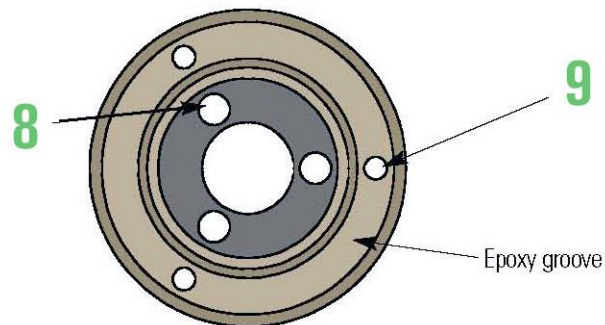


Figure 7

10. The recommended hub surface finish is $R_a = 0.8$ mm (32 mil). MicroE recommends that hubs be made of 303/304 stainless steel* with clear passivate coating. Break all corners and remove all burrs.
11. Verify that perpendicularity between the hub bore and the mounting surface meets stated tolerance of 0.001 inches.

12. Verify that parallelism between the hub mounting surface and the rotary glass scale surface is correct.

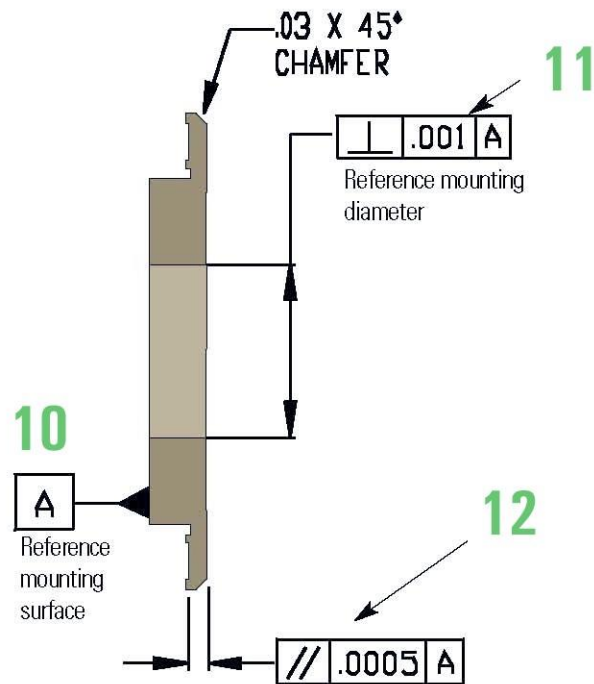


Figure 9

Note: Although aluminum is acceptable, notice the increased CTE mismatch to the grating:

- Soda Lime Glass CTE = 9 ppm/°C
- 303/304 Stainless CTE = 17 ppm/°C
- 6061-T6 aluminum CTE = 24 ppm/°C

HUB DESIGN CHECKLIST

The following checklist is a summary of the guidelines in this Tech Note:

- ☒ The grating reference surface (pattern side) is contacting the hub's mounting surface (choose one):
 - ☐ Yes (recommended) ☐ No (not recommended)
- ☐ The clearance between grating inside diameter and the hub's shoulder is sufficient.
- ☐ The epoxy groove, depth and width, lands on either side of the groove and surface finish of the groove bottom are all correct.
- ☐ The size of the three threaded holes for the mounting clamp is correct.
- ☐ The number and size of the epoxy holes are correct.
- ☐ Indicate reference diameter on hub drawing (usually the hub bore).
- ☐ Indicate reference surface on hub drawing (usually same side as epoxy groove).
- ☐ The parallelism between grating mounting surface and hub is correct.
- ☐ The perpendicularity between hub bore and grating mounting surface is correct.
- ☐ Verify that material type, surface finish, and coatings are all correct.
- ☐ All corners broken and burrs are removed from the hub.
- ☐ Hub design has been reviewed by a MicroE Applications Engineer.